



Evolution of Data Product Processing at JPSS

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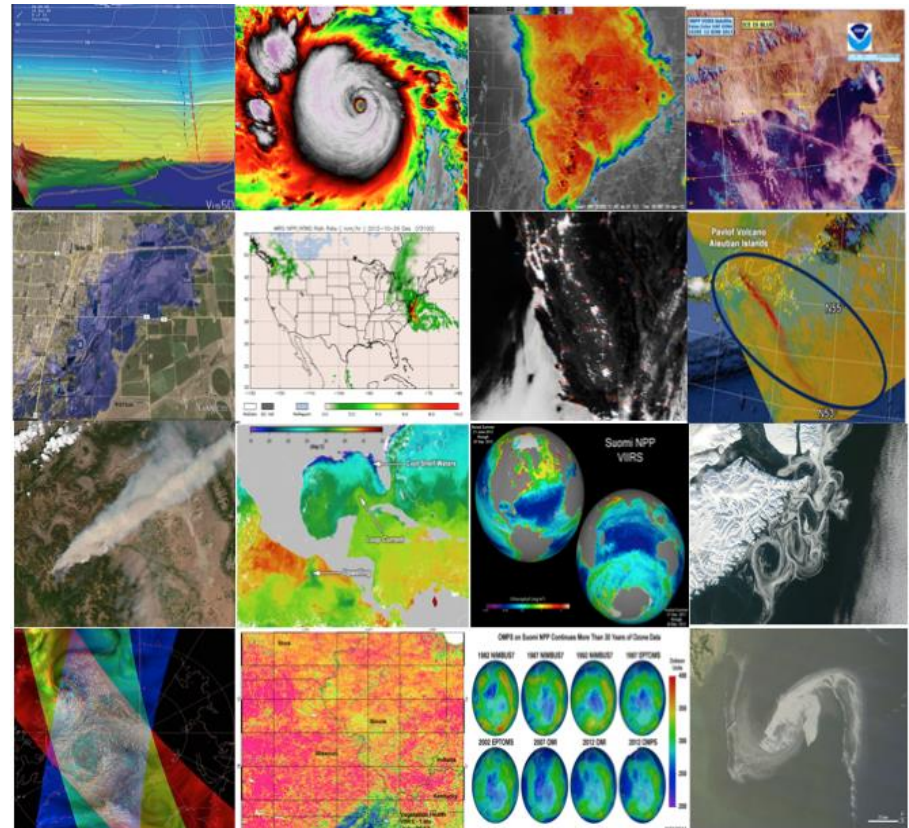
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Outline



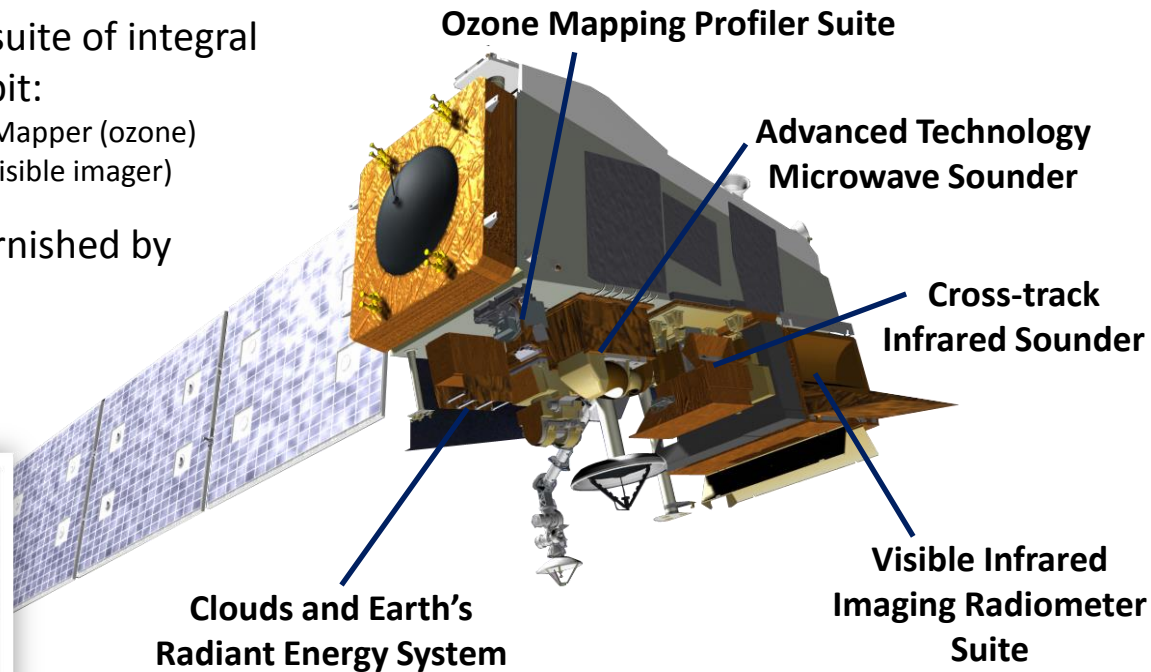
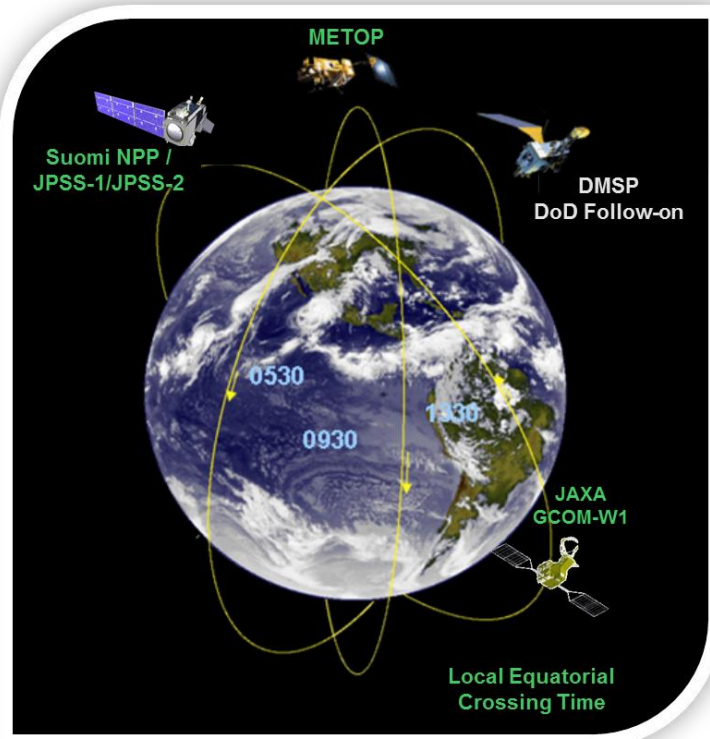
- Background on the Joint Polar Satellite System (JPSS)
- Relevance of JPSS data products
- Data product priorities and how they effect implementation
- JPSS product processing
- Evolving state
- Benefits of changes
- Future work



JPSS Satellite and Global Coverage




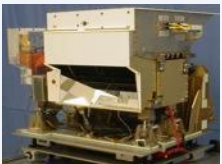
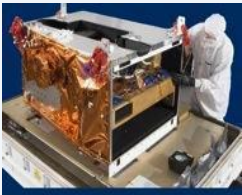
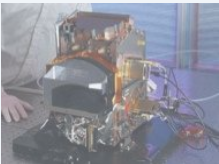

- S-NPP and JPSS satellites maintain a suite of integral weather sensors in the afternoon orbit:
 - ATMS (microwave sounder)
 - OMPS Mapper (ozone)
 - CrIS (infrared sounder)
 - VIIRS (visible imager)
- NOAA operates 2 climate sensors, furnished by NASA in JPSS-2, 3, 4:
 - CERES (radiation budget)
 - OMPS Limb (ozone profiling)



- JPSS implements US Space Policy and international agreements to afford 3-orbit global coverage needed to
 1. Maintain continuity with two prime orbits
 2. Provide 85% of NWP input
- NOAA relies on EUMETSAT Metop satellite coverage of the mid-morning orbit to meet global coverage requirements
- NOAA operates and uses data from DMSP satellites from the Department of Defense in the early morning orbit

Instruments and Benefits

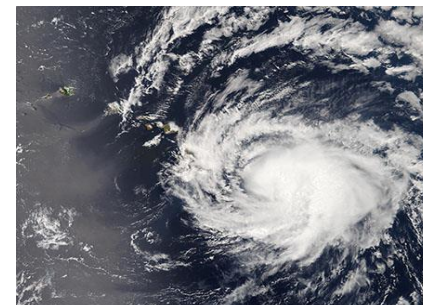


<i>JPSS Instruments</i>		<i>Products</i>	<i>Benefits</i>
	ATMS <i>Advanced Technology Microwave Sounder</i>	Microwave and high-resolution infrared sounders provides: <ul style="list-style-type: none"> • high vertical resolution temperature and water vapor profiles* • Microwave imagery • Precipitation monitoring • Atmospheric trace gases • Infrared ozone <i>* Instrumental in forecasting extreme weather events 3 to 7 days in advance</i>	<ul style="list-style-type: none"> • Approximately 1.2x reduction in model forecast error compared to AMSU • Instrument noise reduced by 3x from AMSU • Assimilated into operational NWS weather forecast models only 7 months after launch
	CrIS <i>Cross-track Infrared Sounder</i>		<ul style="list-style-type: none"> • Approximately 6x reduction in model forecast error compared to HIRS • Assimilated into operational NWS forecast models • Instrument has 0.1° C absolute accuracy • Full resolution data to enable trace gas measurement
	VIIRS <i>Visible Infrared Imaging Radiometer Suite</i>	High-resolution visible imager capable of observing: <ul style="list-style-type: none"> • aerosols • clouds & fog • snow/ice cover • fire & smoke plumes • ocean color • sea surface temperature • vegetation 	<ul style="list-style-type: none"> • Critical imagery used operationally in NWS Alaska Weather Forecast Offices • New Near-Constant Contrast EDR provides nighttime imagery in very low-light sources • VIIRS ocean products are utilized operational to support NOS and NMFS
	OMPS <i>Ozone Mapping and Profiler Suite</i>	Ozone spectrometers used to: <ul style="list-style-type: none"> • monitoring ozone hole • recovery of stratospheric ozone • UV index forecasts 	<ul style="list-style-type: none"> • Collects spatial total column (mapper) and vertical ozone profile (limb) data jointly <i>[except on JPSS-1 where no limb is present]</i> • Data operationally used at the NWS Climate Prediction Center (CPC) • Limb instrument will be provided by NASA
	CERES <i>Clouds and the Earth's Radiant Energy System</i> RBI <i>Radiation Budget Instrument</i>	Scanning radiometer which supports studies of Earth Radiation Budget (ERB)	<ul style="list-style-type: none"> • CERES is part of the NOAA baseline for S-NPP and JPSS-1 • NASA will furnish the RBI instrument for JPSS-2, 3, 4 missions • Continues a more than 25 year old Earth radiation data record at NASA



JPSS provides essential data for all NOAA Line Office mission goals

- The JPSS program directly supports:
 - Continuity of observations to support NOAA Operational Monitoring and Forecasting of the atmosphere and ocean
 - Imagery for critical events for nowcasting purposes
 - Climate monitoring and prediction through sustained, high-resolution measurements of the atmosphere and earth surface
- Most critically, JPSS impacts:
 - Numerical weather prediction to enable accurate 3-7 day ahead forecasts
 - Gives high confidence to emergency managers in advance of severe weather events
 - Operational weather and environment satellite observations for Alaska and Polar Region operational forecasting
 - Global coverage and unique day and night imaging capabilities for civilian and military applications



Hurricane Isabelle approaching the Hawaiian Islands (2014)



Smoke from fires in Alaska and Canada move into lower 48 States (2015)



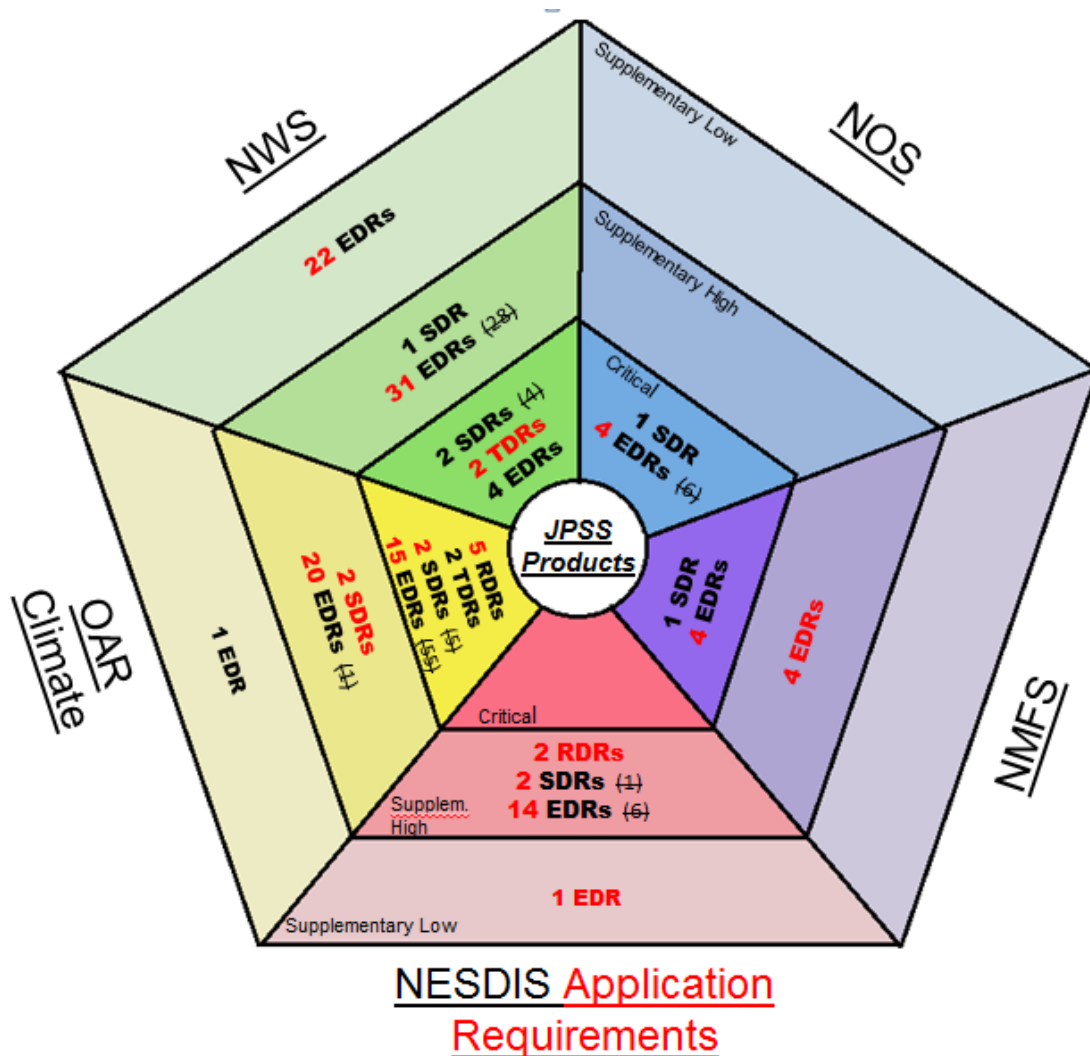
Massive winter storm in Northeastern U.S. (2014)

Without JPSS, the US will experience an immediate degradation in weather forecasting capability

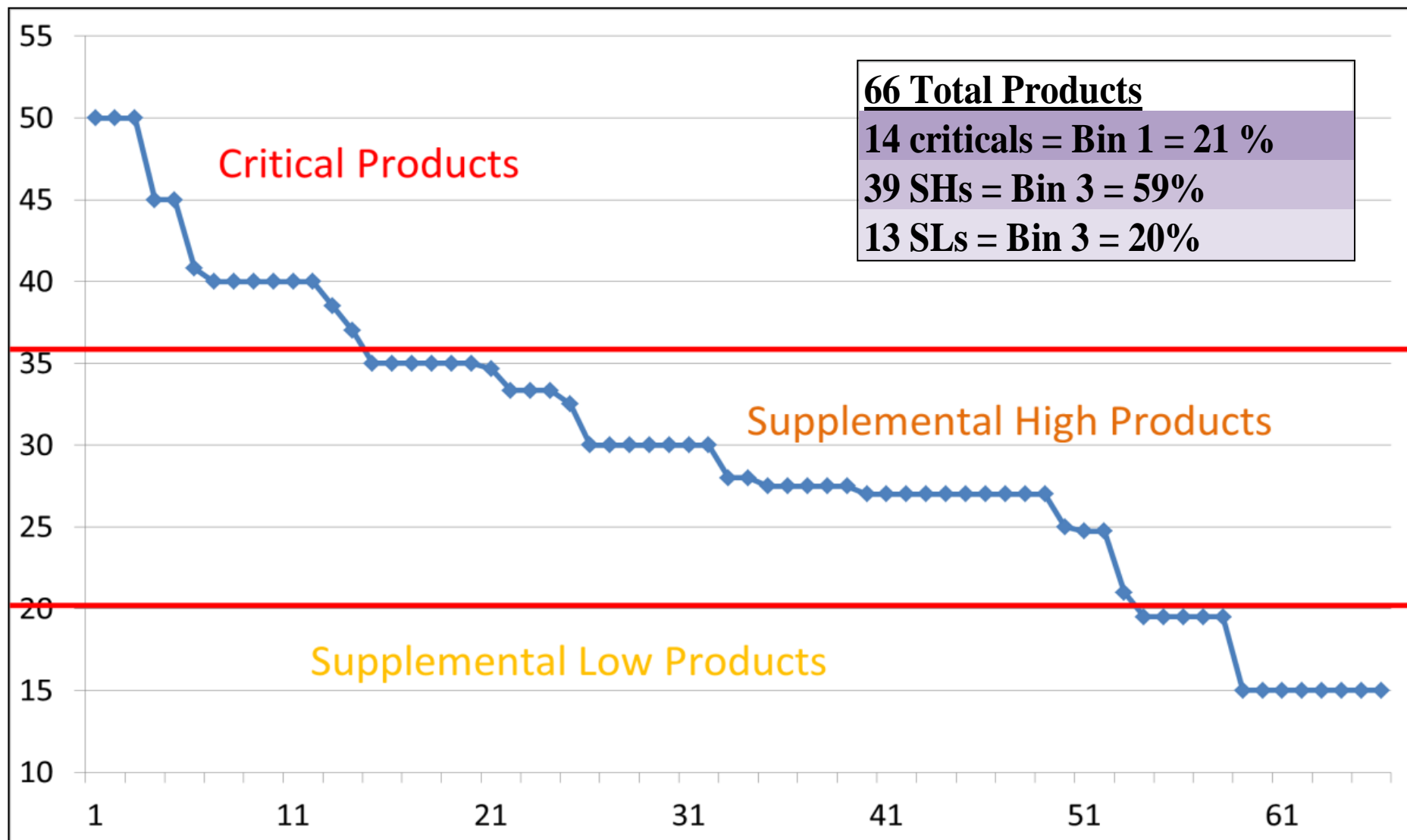
Data Product Requirements



- Each NOAA Line Office is a stakeholder in the JPSS Program, and therefore their product requirements are maintained within Level-1 documentation
- Provided by the Low-earth Orbiting Requirements Working Group (LORWG) these requirements are consistent with Line Office missions and objectives
- All requirements are traced to the NOAA Consolidated Observing User Requirements List (COURL)
- These are weighted and rolled into a single set of JPSS science product requirements



Data Product Requirements



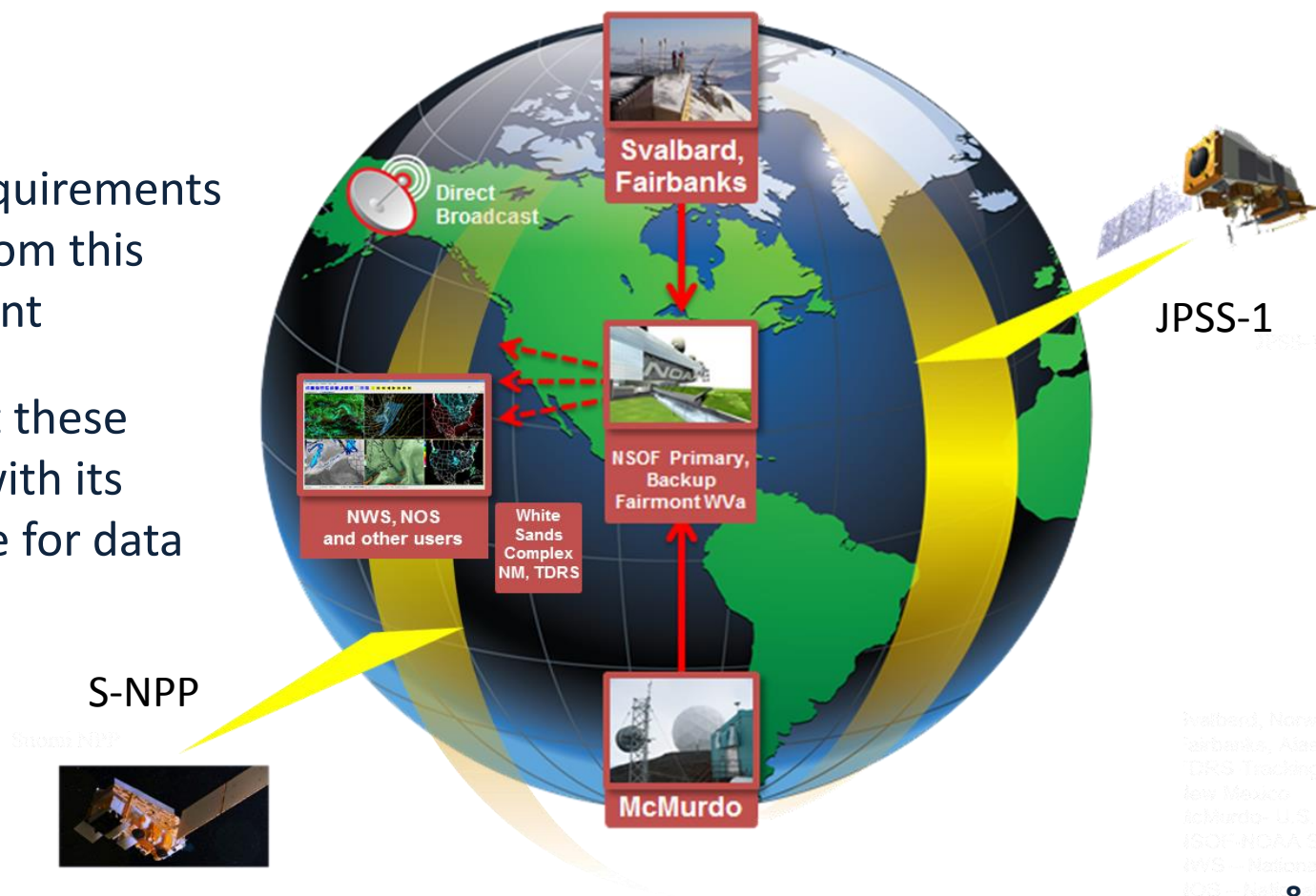
These priorities reflect the combined requirements of the following NOAA Line Offices:

NWS, NESDIS, NOS, NMFS and OAR

How Priorities Effect Implementation



- NOAA users define how critical JPSS data products are to their missions, highlighting the following criteria:
 - Timeliness (operational/research)
 - Data Quality
 - Reliability
- Data availability requirements are then derived from this criticality assessment
- JPSS works to meet these availability needs with its system architecture for data delivery

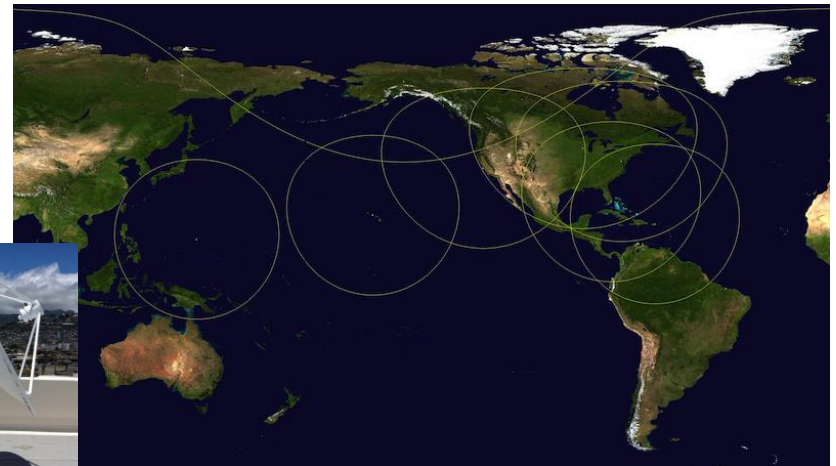


Svalbard, Norway
Fairbanks, Alaska
TDRS Tracking
Fairmont, New Mexico
McMurdo - U.S.
NSOF - NOAA
NWS - National
JPSS - NOAA

Implementation Platforms



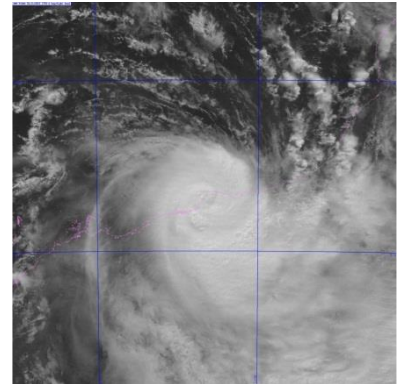
- In the world of enterprise algorithms, enterprise ground system processing solutions offer cost-effective and consistency across multiple platforms
- JPSS offers two types of data processing
 - Stored Mission Data (SMD): longer latency and high fidelity
 - These are the Interface Data Processing Segment (IDPS) and NPP Data Exploitation (NDE) Systems
 - JPSS Program Systems Engineering (PSE) is completed a trade study with the Office of Satellite Ground Systems (OSGS) as the best way to leverage both SMD systems
 - Direct Broadcast (DB): Community Supported Processing Package (CSPP) allows for pre-operational basis for local/regional use



Evolving State



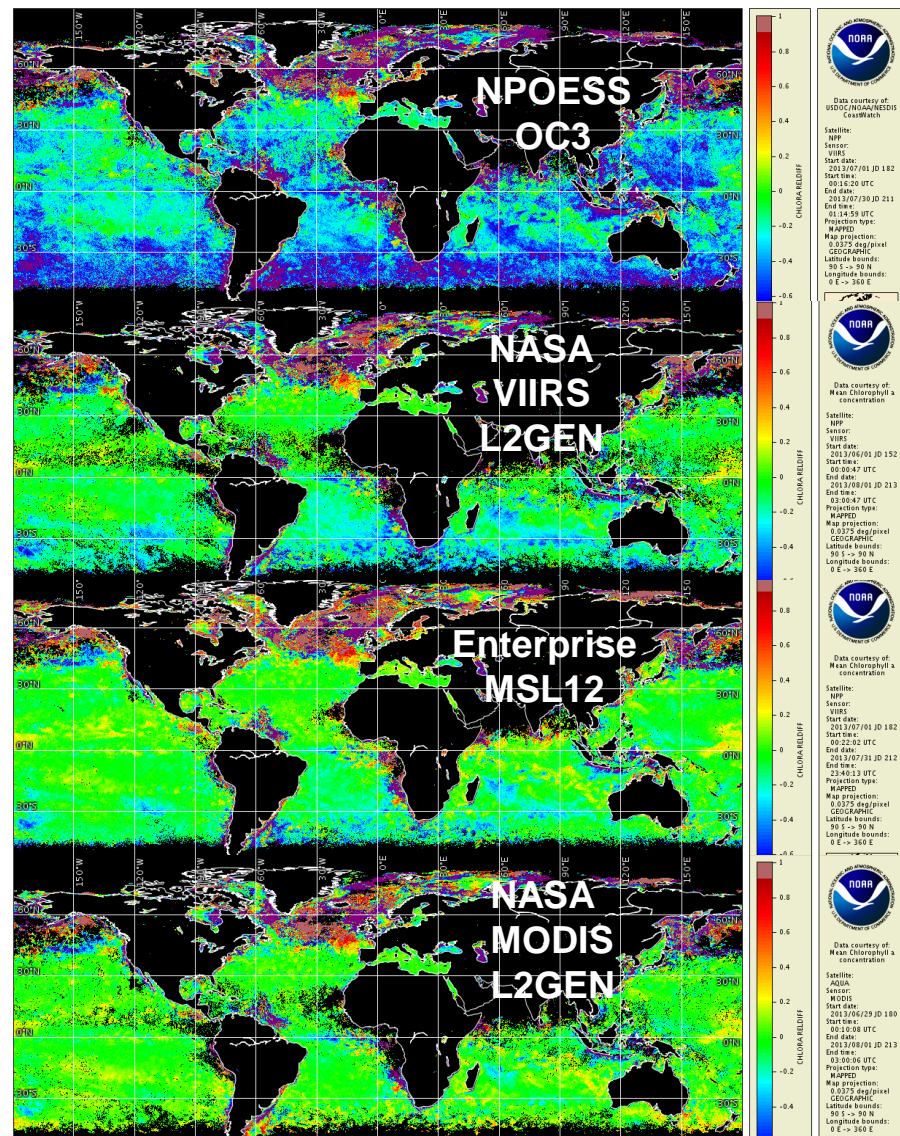
- 2013 - JPSS assessed redundant NPOESS legacy and NOAA multi-sensor heritage algorithms based on data product quality and user feedback
 - NOAA user communities preferred the heritage multi-sensor algorithms for sounding products, sea surface temperature and ocean color
- 2014 - JPSS directed NOAA algorithm scientists (STAR) to pursue multi-sensor enterprise algorithm solutions for future implementation
- 2015 - Program Systems Engineering completed an implementation trade study on how to best utilize the IDPS and NDE processing system based on criticality and processing level:
 - **Mission Unique** → Generated on IDPS
 - Within scope of the JPSS Program
 - Fundamental sensor-specific data that is inexorably tied to instrument performance
 - Basic foundation on which all higher-level products are processed
 - Includes KPPs, Raw, Temperature and Sensor Data Records
 - Must be sustained/produced in a COOP (backup) situation
 - **Enterprise** → Generated at ESPC, NDE
 - Within the scope of the NOAA Enterprise Ground project
 - Support implementation of scalable, multi-sensor processing approaches across multiple platforms
 - Includes Environmental Data Records and all higher-level products
 - Development, production and sustainment may be needed in a COOP (backup) situation
- 2015 - JPSS updates requirements and implementation plans to accommodate the Polar Follow-On missions of JPSS-3/4



Benefits of Implementation Changes



- The Mission Unique/Enterprise split of products allows:
 - IDPS to focus on multiple streams of low latency Mission Unique KPP products, critical to NWS
 - NOAA to leverage any changes to Enterprise Ground processing initiatives
 - NOAA can focus on science algorithms and work through internal processes to update and include additional data products (Satellite Products and Service Review Board [SPSRB] process)
- Cost and schedule impacts are minimized as PFO is included in the baseline since the critical products will be prioritized in IDPS



Monthly Relative Difference for
July 2013



JPSS will ensure development and process consistency across its product generation systems by leveraging NOAA enterprise investments in its plans through the end of the JPSS-4 mission

Upcoming milestones include:

- Implementation of the all enterprise algorithms within NDE is planned for in FY16
- With funding for the Polar Follow On, JPSS is updating baseline requirements documents to accommodate the additional missions
- JPSS will consider some incremental sensor improvements to the current generation, if cost and schedule are not impacted
- Planning of the next generation of polar satellites with the Space Platform Requirements Working Group (SPRWG)

